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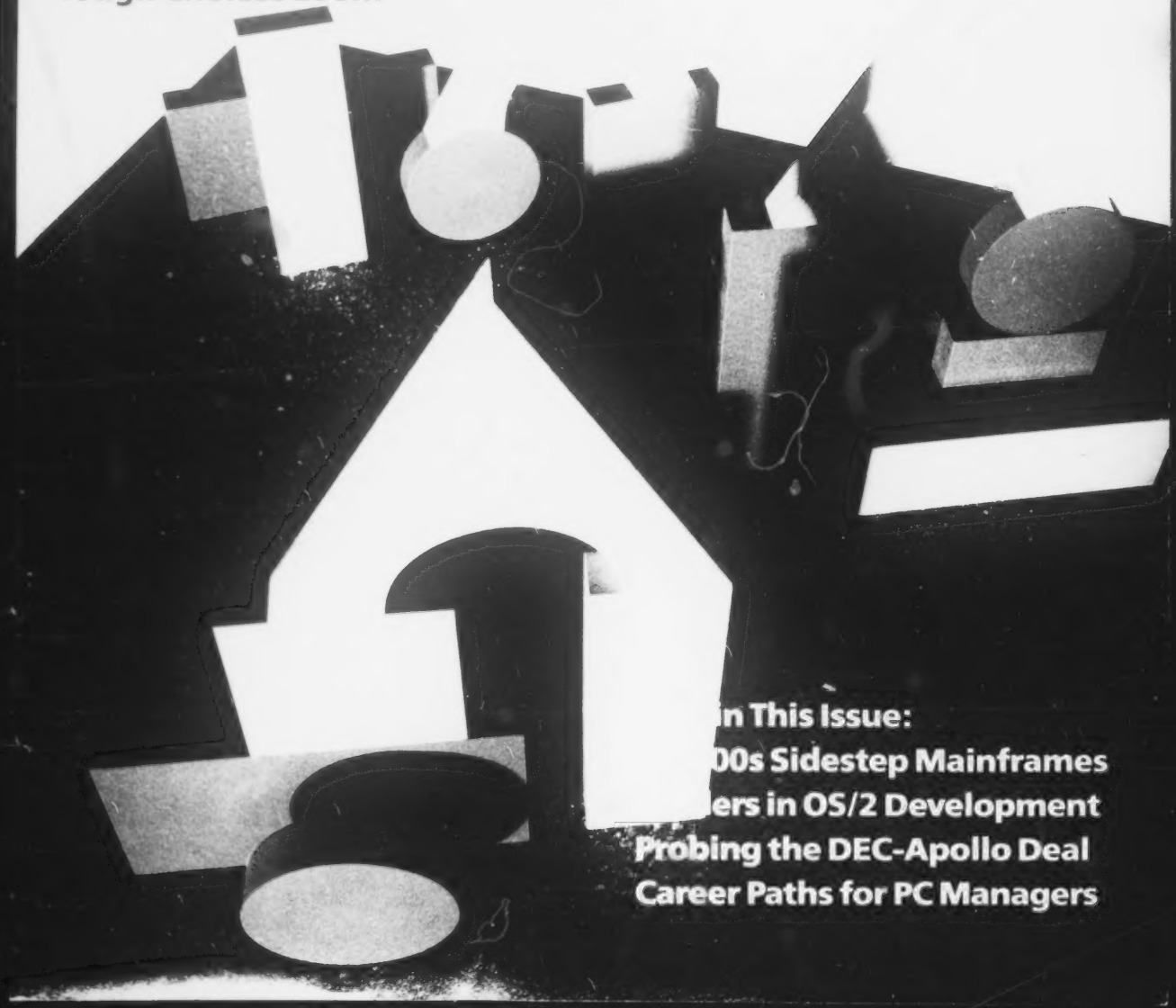
SPECIAL

DATA

Integrated Computing Environments

New Architectures Take Shape, but Tough Choices Loom



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ers in OS/2 Development

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Career Paths for PC Managers

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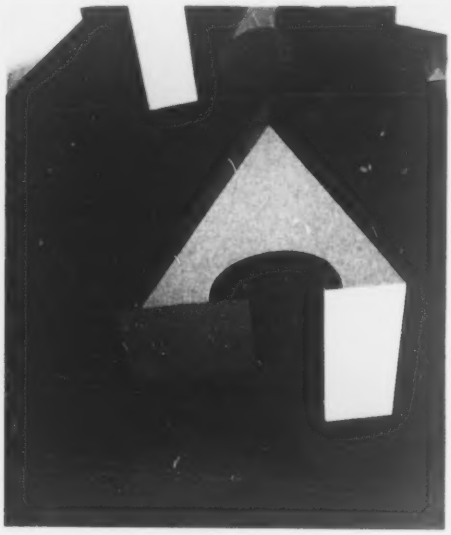
FOR MANAGERS OF INFORMATION TECHNOLOGY WORLDWIDE



Integrated Computing Environments 18

BY GARY McWILLIAMS ... A new generation of application development tools is poised to deliver the new user experience and increased productivity integrated computing environments promise. The question is what approach to integrated computing environments will emerge as the prevailing one: tying together disparate systems. But with no advertised formula, many companies are facing difficult choices as they move toward

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Cover Photography by Curt Berner

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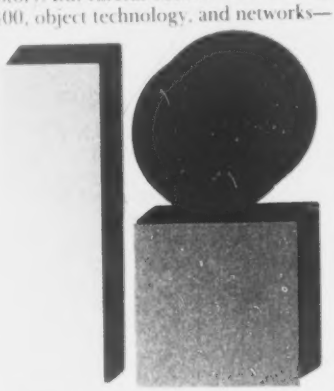
Building a Better Environment

Productivity has long been the name of the game in running IS operations. From the first commercial computer installations of the 1940s to the massively complex systems being erected today, IS managers and their harried staffs of analysts and programmers have worked to get more from their machines.

Suddenly, however, vendors and managers of information systems are finding a new source of improvement. It's not within the computers themselves, but rather what lies outside of them: the environment. Not the larger environment as you and I know it, but the organizational and technical infrastructure within which you manage your employer's information resources.

The discovery is far more important than most realize, and it's occurring in many more ways than people understand. This issue of DATAMATION, for example, contains one obvious environmental report, our cover story. But careful examination of other stories—on topics as diverse as OS/2, the AS/400, object technology, and networks—reveals that users as diverse as Big Eight firms and bakeries are singly focused on one objective: creating environments, defined by computers and continents, that will enable their enterprises to grow more productive.



CREATING PRODUCTIVE environments is a major IS challenge

In "Integrated Computing Environments," p. 18, Section Editor Gary McWilliams confronts the issue head-on, carefully examining the new environmental offerings of major IS suppliers and the reactions of users to them. The goals of creations like AT&T's Application Operating Environment, he writes, suggest an impact that reaches outside the IS department. Consistent behavior across operating systems, common programming interfaces, and distributed operation—the most often-stated goals—portend change for how developers approach software design and how users interact with a system.

Predictably, in an age in which customers seem to know more about their suppliers' business than the suppliers themselves, McWilliams encounters several users that already are building their own parts of the brave new worlds of computing.

Construction of a similar sort is under way at some of the leading PC/workstation suppliers and general systems companies, according to Dallas Bureau Manager Bob Francis in "Who's on Deck with OS/2," p. 45. Compaq, Dell, Sun, NCR, HP, and others have assigned crews of software developers to build real products out of the promises of the OS/2 environment. Most see the second generation desktop operating system as the means to serve their customers' more sophisticated applications needs better than they can with DOS and, in some cases, UNIX.

Environmental changes are sweeping across the other tiers of computing as well. Notably, several IBM mainframe shops are embracing AS/400 midrange systems as an alternative to further S/370 investments required by new application demands. In "The AS/400's Surprise Role," p. 49, author David Stamps measures the gains in productivity that users such as Pepperidge Farm and Arco realize by expanding beyond their S/370 worlds into AS/400 domains. Similar improvements are expected by customers of Digital and Apollo in the wake of their joint announcement to codevelop a networking extension to Apollo's remote procedure call. Leila Davis's article "From WANs to LANs," p. 73, captures how ecstatic users like those at the University of Iowa are at the prospect of being able to tie remote computing resources to workstations at the school via RPC.

These articles should convince you that building a productive systems environment is a tangible objective. Environment, in fact, may be the new name of the IS game.

Tim Mead

Tim Mead, Editor-in-Chief

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Japan Prepares for Software Crisis

With the prospect of a million too few software engineers in Japan by the year 2000, industrial companies and the government have begun widespread software research and retraining projects.

BY STUART M. DAMBROT

It's taken for granted that the twenty-first century will be an age of pervasive computerization, global telecommunications, and widespread automation. Still being debated, however, is the question of dominance: will the future belong neither to the militant nor the meek, but rather to the technologically advanced? If the latter, Japan stands a good chance of becoming the world's leading economic force.

Japan's technological prowess is not ubiquitous, however. As a matter of fact, Japan has a major weakness: software. Not only is the West regarded as having superior software capability, but Japan also has a rapidly escalating shortage of software engineers.

In an attempt to overcome problems in the areas of software productivity, development, and incompatibility, the Japanese Ministry of International Trade and Industry (MITI) is applying proven manufacturing automation techniques to the software design process. Its Software Industrial Generalization & Maintenance Aids (SIGMA) project is a five-year, $194 million (¥25 billion) effort to automate software development and create standardized Unix-based data structures, communications interfaces, and applications platforms.

But what about major Japanese companies—what are they doing, and planning to do, about this looming software crisis that threatens the future of their internal information processing systems, user services, and overall productivity? Are they interested in the results of the SIGMA project, but perhaps unwilling to pay for expensive SIGMA workstations?

The answers differ from company to company, but there is an underlying sense of optimism. In general, the following tactics will grow in importance:

- retraining of existing employees;
- contracting out of software projects;
- implementing structured programming aids; and
- automating programs.

MITI, which predicted the programmer crunch in the mid-'80s, expects that by the year 2000 Japan will need 2 million software people to handle increased programming requirements, but that it will only have 1 million of them (see "Japan's Software Skills Crisis").

This shortage projection is based on anticipated program volume, or lines of code. According to MITI, the man-hours required to generate this code will increase faster than the number of available programmers.

In rising to meet the challenge, Japanese companies differ as to the ways they plan to compensate for the projected crunch, but they all subscribe to the same official position. While admitting that MITI's depiction of coming trends is accurate and allowing that they will notice the consequences in their internal programming departments, they maintain that they won't really be affected.

After all, they point out, the Japanese government and industry are not at odds with one another. MITI is on their side, and so the advance warning its projections afford is welcome; it gives them that much more time to plan. They also can anticipate government assistance in the form of projects like SIGMA.

Sadao Maeda, senior manager at the Engineering Strategy Planning headquarters of Nippon Telegraph and Telephone (NTT) in Tokyo, feels that "from MITI's viewpoint, the volume of software that must be developed will be increasing, but that from NTT's point of view, the shortage won't be that serious. "For one thing," Maeda explains, "we're increasing the number of university graduates we're hiring as programmers. Many young engineers would like to join NTT."

Kiyonori Konishi, also a senior NTT manager, adds, "There are now 280,000 employees at NTT, and a large number are engineers. We're planning to retrain many of these employees as programmers." The giant telecom firm will also increase the software development work done at its subsidiary, NTT Data Commu-

Illustration by Scott A. MacNeil

nications, according to Komishi.

This is the same strategy that has been adopted by NRI & NCC Co., a recently (January 1988) merged subsidiary of, and provider of information services to, Nomura Securities. NRI & NCC plans to offset the coming shortage largely by developing more software through outside contractors, as well as by continuing to purchase software packages. Meanwhile, Toshiba augments its subcontracting by transferring internally developed software tools to its outside developers, which then employ the tools in preparing code for the company.

A number of Japanese firms have developed internal computer-aided and automatic programming technology to help them overcome the lack of software personnel. Nomura's NRI & NCC, for instance, has several systems it uses to increase programming productivity at different stages of the software engineering cycle, and it is "looking to purchase a good CASE system," says Shintaro Maeda, NRI & NCC spokesman.

CASE tools will be used in the design phase, which NRI & NCC defines as business analysis, conceptual design, and basic design. For the past seven years, NRI & NCC has been using computer-aided structured programming (CASP)—a limited type of CASE system developed by the company—during the programming phase (program design and subsequent coding) and for testing and debugging.

"With CASP," says Shintaru Maeda, "programmer productivity has increased from an average of 1,000 to 1,500 lines of code per month to 5,000." During the programming phase, another NRI & NCC tool known simply as G (for graphic system) automatically converts programmers' flow charts into COBOL code. Finally, another internally developed tool known as the Integrated Workbench (IWB) is used during testing and debugging.

In NRI & NCC's software development network, a variety of workstations and mainframes connected in a ring-topology LAN communicate over optical fiber. Included in each LAN are a number of manufacturers' SIGMA workstations being used on a pilot basis in tasks ranging from program design through installation. Software engineers are now developing an Operation and Maintenance System (OMS) for postinstallation use and have as their overall goal the integration of these now separate software productivity tools under their Information Technology Project (ITP).

Sumitomo Workers Learn New Skills

Sumitomo Metal in Tokyo has taken a very precise approach to retraining employees. Its blue-collar workers are trained for six months and are redeployed as programmers, while its white-collar staff members study for one year to become higher-level software engineers.

"At this time," says systems engineering assistant general manager Susumu Misago, "there are about 200 retrained programmers on the job—roughly 20 graduates from each six-month class since the program started two years ago. There are also 10 reeducated systems engineers; classes began last year, and only 10 employees complete the 12-month course each year."

One key to Sumitomo Metal's system is the integrated set of structured programming aids developed for use in all phases of software development. Standard forms are used for each step, from high-level design through coding, data structure specifications, and screen layout. Programmers work from statements generated by software engineers, limiting the options available to them and thereby further reducing coding time.

In addition, Sumitomo uses guidelines to determine which employees—at what age and at which point in their careers—are best suited for particular responsibilities. Three employee groups—23 to 32 years old (up to 10 years with the company); 33 to 42 years old (10 to 20 years with the company); and over 42 years old (over 20 years with the company)—are correlated with the categories of software engineering management, software engineering innovation, software engineering applications systems development, software programmers, and programmers limited to standardized coding procedures.

Each matching of group to category is rated according to average employees' ability to perform that job. "For example," explains Misago, "innovative ability is seen as being optimal for ages 23 to about 38, acceptable from 39 to 45, and declining after that point. On the other hand, employees are not even considered as potential managers until they are at least 33, but are deemed able to perform well throughout the remainder of their careers."

Such a standardized retraining system isn't for everybody. What makes it possible in Japan is the highly uniform nature of Japanese society and business practices.

However, Toshiba has by far the most substantial and ambitious software productivity enhancement effort under way. Its Systems and Software Engineering Laboratory is heavily committed to a 17-year project for developing IMAP (Integrated Software Management and Production Support System), a system designed to advance industrial software production. Toshiba plans to achieve this so-called industrialization of software production by three means: consistent production quality based on reusable software modules, automation of management functions, and an integrated production system.

IMAP's Next Step

"The IMAP project began in 1983," recalls Ikumune Takahashi, senior research manager at Toshiba, "and we are now internally promoting its use." This second phase of the project is called Step 90, since it is scheduled to be completed by 1990. At that point, IMAP will be upgraded to incorporate user feedback and advanced technologies, including design application AI, software engineering knowledge bases, and greater degrees of "hidden programming"—that is, more powerful man/machine interfaces and greater user friendliness.

IMAP consists of four components:

- life cycle (conceptualization, design, production, integration, and system analysis);
- supporting tools (reusable components, development aids);
- environment (technical support, database); and
- management system (cost control, quality control, technical management).

IMAP is being targeted for use on engineering workstations in a distributed development environment, i.e., an arrangement something like NRI & NCC's software and development network. Toshiba estimates that IMAP will prove useful in 90% of the effort expended in developing application software for control, factory automation, engineering automation, and other microcomputer areas.

MITI, meanwhile, is not sitting still. As SIGMA enters its final year and its systems are evaluated, two follow-up projects are being readied to begin in fiscal 1989. SuperSIGMA, a five-year extension of SIGMA for which MITI will reportedly request $775,000 (¥100 million) in first-year capitalization, will continue to develop interfaces for incompatible computers. Specifications for a standard operating system will also be devised, and the application of AI and expert system technology to automatic programming will be investigated.

The details of SuperSIGMA will depend on feedback from 80 users now testing the

SIGMA prototype workstation, according to Akio Ohnishi, deputy director of MITI's Software Industry Division. Ohnishi points out that with 189 companies involved, SIGMA is "the largest standardization effort in the world, as well as the first to produce actual hardware and software."

The other follow-up project (as yet unnamed) will be conducted jointly by MITI and the Ministry of Labor. Regional centers will train qualified local citizens as software engineers, while simultaneously promoting the SIGMA standards.

Over the next 10 years, some 100 centers will be established either as joint ventures of the public and private sectors or as nonprofit organizations. The estimated development costs are a whopping $2.3 billion (¥300 billion), with first-year budgetary requests coming roughly to $194 million (¥25 billion). The government intends to train 200,000 extra software engineers this way.

No Crisis To Come, Say Some

It all sounds very impressive—but in the end it may not be necessary. By the turn of the century (the time when the programmer shortage is expected to reach its peak), new computer architectures and software engineering tools may reduce the need for these measures.

Casio Computer Co., for example, has reportedly successfully tested a prototype of its Automatic Data Processing System (ADPS), which it says does not need software. ADPS preprogrammed hardware is driven by codes that are input with the data to be processed.

Some industry observers feel that such an outcome is a strong possibility. Masanori Moritani, senior researcher at NRI & NCC, anticipates that by 2000 computer hardware "will have changed drastically, and the projected shortage will by that time be based on what has become an old concept. In the future," he argues, "mainframes will not be needed; they will be displaced by 32-bit microcomputers." Nevertheless, he concedes that "SIGMA is a useful concept," because "it will allow programmer productivity to increase rapidly" even if the shortage does not actually materialize. Such an increase will be urgently needed in the coming years before the advent of the era of full-fledged automatic programming. ▭

Stuart M. Dambrot is a freelance journalist based in Tokyo.

Japan's Software Skills Crisis

By the year 2000, Japan's MITI predicts, over 2 million software engineers will be needed, but only 1 million will be available.

YEAR		1985	1990	1995	2000
Demand*	Software Engineers	182	327	536	828
	Programmers	289	520	853	1,328
	Total	471	847	1,389	2,156
Available*	Software Engineers	165	220	296	406
	Programmers	263	376	580	774
	Total	428	596	876	1,180
Shortage*	Software Engineers	17	107	240	422
	Programmers	26	144	273	554
	Total	43	251	513	976

*In thousands
Source: MITI, Machine Information Industry Bureau, Tokyo.

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Supplier Performance Update: Flatter Sales in '89

No upturn in computer and communications equipment sales seen until 1990. Result: A buyer's market in '89.

BY MADELINE FRANCHI

United States-based manufacturers of information systems watched new orders mount in 1988 during the improved business and investing climate. By year-end, new orders reached $107.2 billion, a climb of 8.6% on top of the 7% hike in 1987.

Of course, the rebound in new orders translated into heightened shipments activity. U.S. factory shipments of information processing systems reached $107.3 billion in 1988—a rise of 9.4% from the year before. That represented the best annual growth since the 18% increase back in 1984.

But even before we turned the corner into 1989, growth in new orders had slackened. Witness the declining quarterly growth rate. In the first quarter of 1988, new orders advanced 11.7% over the level recorded in the first three months of 1987. Over the course of the year, however, quarterly gains weakened so that orders in the final quarter grew just 6% from the year before. Growth continued, but at slower rates—a sure sign of business contraction.

Shipments growth will be following suit, posting only a minimal rise in 1989 before turning around again in mid-1990.

The two factors that helped boost sales in 1988—business investment and exports—are precisely the sectors dragging down growth rates in new orders and shipments of information systems in 1989. In 1988, U.S. business purchases of computers and office equipment ballooned 24% to a total of $102.2 billion on a constant 1982 dollar basis, while purchases of communications equipment advanced just over 5%.

With the bulk of the buying now over and interest rates on the rise, however, investment in new equipment will take a rest. Purchases of computers and communications equipment are expected to increase again, but by a slower 3% to 4%.

In international trade, the depreciating greenback boosted U.S. exports of computers and telecommunications equipment in 1988. According to U.S. Commerce Department data, computer and office equipment exports expanded 24%, while telecommunications exports skyrocketed 27%. Exports are expected to increase again in 1989, but the rise will be less than a third the strength of last year.

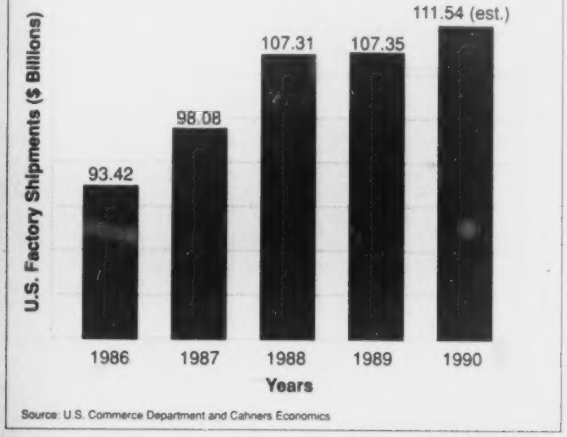
The signing of the U.S.-Canada Free Trade Agreement is a gain to American computer and communications equipment manufacturers. Canada is second only to the European Community as a destination for U.S. electronics products, particularly computers, office machinery, and data processing equipment. However, forecasts say that growth in the Gross Domestic Product in Canada will slow in 1989 from 1988's pace. This may thin north-of-the-border export gains in 1989.

During this slower growth phase, IS vendors are likely to maintain even tighter control on quality and customer service than before and to review and adjust prices. So if you are in the market to buy information processing equipment, this year might be a good time.

More economic information can be obtained from Cahners Economics Department, 275 Washington St., Newton, MA 02158, (617) 964-3030.

U.S. IT Shipments Flat for 1989

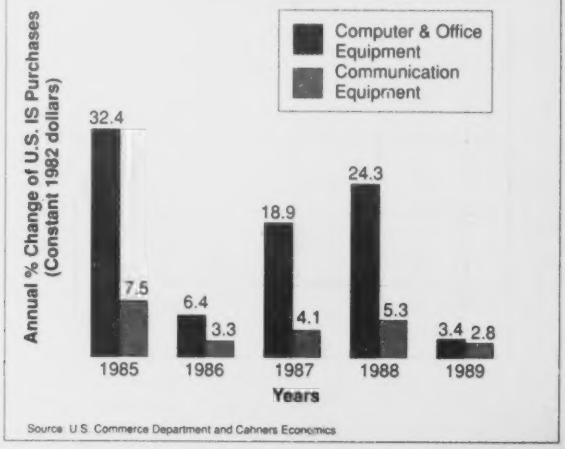
No growth suggests 1989 could be a year in which buyers can get good deals from U.S. suppliers.



Source: U.S. Commerce Department and Cahners Economics

U.S. Buyers Trim IS Plans

After a booming 1988, 1989 doesn't look good for IT sales.



Source: U.S. Commerce Department and Cahners Economics

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